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(71) Applicant: ANTONIO MERLONI S.p.A.
I-60044 Fabriano (Ancona) (IT)

(72) Inventor: Merloni, Antonio
I-60044 Fabriano (Ancona) (IT)

(74) Representative: Coppi, Cecilia
c/o Studio Internazionale Dott. Coppi,
Via del Cane No. 8
I-40124 Bologna (IT)

(54) Laundry washer-driers

(57) In the air circulation path of a laundry washer-drier air is driven by a fan (7) to passover a heating element (8) and into the drum containing the laundry, and a duct (4) carries the air back to the fan from the interspace (5) between the drum and a tank enclosing the drum. For cooling the air to reduce its moisture content cooling water is delivered into the interspace (5) through a flow line (6) extending via the detergent dispenser (9) of the machine. Since the flow of air in the collector duct (4) does not come into contact with cooling water, it can be accelerated in order to improve the heat exchange and reduce drying times and accurate monitoring of the degree of residual moisture can be carried out in this duct.

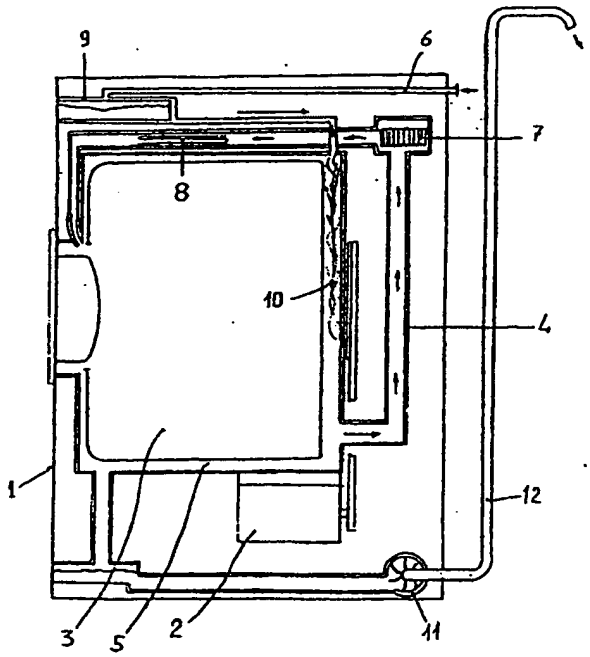

FIG1

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Description

The present invention relates to so-called laundry washer-driers for washing and drying laundry.

There are known laundry washer-driers equipped for closed loop air circulation and having a device for causing recirculation of air at the end of the washing and spinning cycles for completely drying the laundry.

In a known arrangement for air circulation, air enters the drum containing the laundry, is heated by a heating element, and after passing through the laundry and out through holes in the drum, enters drainage ducts of the machine and finally returns to a circulation fan which forces the air to enter the drum again. The air when passing through the hot laundry, removes moisture therefrom. As the air passes through a recirculation duct leading back to the fan it comes into contact with water and is cooled, thereby causing moisture to be condensed out of the air. Circulation of air in this manner for 70-120 minutes allows the laundry to be dried completely.

An arrangement is also known in which air is forced by a fan through a heating element and is then introduced into the drum where it contacts the wet laundry and takes up moisture. The moist air then passes into a recirculation duct where, suitably cooled with water, it gives up the moisture, after which the air is returned to the fan to repeat the cycle. The air cooling duct is generally referred to as a condenser. The condensed water, together with the cooling water, are removed from the machine via the water drainage duct of the machine.

Other known arrangements are substantially similar to those described above, entail the introduction of air and heat into the laundry which gives up moisture to the air which is then introduced into a condenser (cooled by water) where it gives up moisture. When the cycle is repeated for a certain period, the laundry is dried.

An essential component of these drying arrangements is the condenser where the air makes direct contact with cold water and gives up moisture.

The condenser is normally formed by a duct with a substantially vertical section in which the current of hot and moist air, coming from the base of the machine, meet a countercurrent of water coming from the top to cool the air and condense moisture out of the air.

The main drawback of these known arrangements lies in the fact that the stream of cooling water prevents the effective drying of the air because water particles become entrained by the air flow. Moreover, the speed of the flow of air has to be kept low to prevent further water particles being entrained.

Systems, known as dry collector systems, are also known in which cooling is obtained without the flow of moist air meeting the cooling water. This avoids need for devices adapted to trap the water droplets, which are always complex and therefore expensive. Moreover, the cooling fluid, as it does not contact the flow of moist air, can be much faster, thereby improving the heat exchange. Nonetheless the need for a separate cooling water path complicates the machine.

The object of the invention is to provide a washer drier with an arrangement enabling relatively rapid cooling of the moist air flow, and allowing continual monitoring of the residual moisture by means of appropriate sensors.

In accordance with the invention there is provided a laundry washer drier comprising a rotatable drum for holding the laundry and disposed in a surrounding enclosure, a substantially closed air circulation path including a duct leading from the enclosure to a device for causing circulation of air, and means for supplying cooling water for cooling moist air flowing in the air circulation path, characterised in that the means for supplying cooling water is arranged to deliver the water into the interspace between the drum and the surrounding enclosure.

With a washer-drier according to the invention the collector functions of the duct leading from the drum enclosure and the circulation device are separated from the condenser functions of cooling and removing moisture from the air. The invention is based on the recognition that in order to condense the moisture in the air circulating in the drying system of the machine, it is not necessary to cool the air in the collector section of the circulation path and it is sufficient to cool the air with water at an appropriate point within the interspace between the drum and the enclosure, through which interspace the moist air passes upon leaving the drum. Water condensed in the interspace and the cooling water can be removed through the drain which is connected to the drum enclosure.

In order to prevent water, introduced to condense moisture, from wetting the laundry that it is wished to dry, it is preferable for the drum not to be perforated on the side at which the cooling water is introduced.

It is readily possible, in practice, to identify the locations at which the introduction of water for the cooling of the condensate is most efficient. The main condition is that these locations are selected in zones through which the air passes from the holes of the drum to the collector of the air circulation path.

Excellent drying results can be obtained by supplying the water along the walls of the enclosure via the detergent dispenser of the washer-drier, which allows the invention to be embodied in existing machines without substantial modification.

Other advantages of the invention lie in the fact that within the drum-enclosure interspace large cooling surfaces are available with an optimum heat exchange enabled by a high speed flow of the cooling fluid, and monitoring of the moisture present in the air flowing through the collector is not distorted by the presence of cooling water.

Other objects and advantages are set out in the following description and the accompanying drawing which shows, in diagrammatic and exemplary form, a possible practical embodiment of the invention. In the drawing, Fig. 1 is a vertical cross-section through the washer-drier.

The casing of the machine contains the main motor 2, and a perforated drum 3 for receiving the laundry and which is rotated by the motor 2. The drum is enclosed within a tank to a lower portion of which is connected a circulation duct 4 for the air circulated during a laundry drying cycle. An interspace 5 is defined between the drum and the surrounding tank and cooling water is introduced into this interspace through a water supply line 6 without coming into contact with the moist air having entered the duct 4. The duct 4 leads to a fan 7 which forces the air to flow back to the drum after passing over a resistance heater 8 which heats the air.

The cooling water is introduced adjacent the rear wall of the drum 3 which, unlike its peripheral wall is not perforated.

The cooling water may be introduced into the interspace 5 and also into contact with the drum 3, via the detergent drawer 9, as illustrated. The flow of cooling water can also serve to clean away fluff 10 deposited during the air drying cycle. This fluff passes with the cooling water and water condensed out of the air into the drain outlet of the machine leading from the tank, and is discharged externally by means of the pump 11 via the drainage hose 12.

Since only moist air flows in the duct 4, it is possible to provide in this duct moisture sensors, (of a known type and not therefore described in detail) which continually detect the degree of dryness of the air flowing in this duct.

The described washer-drier obtains the above-mentioned objects and in particular allows the cooling of the flow of moist air in short periods of time.

The present invention, described and illustrated in a diagrammatic and exemplary form, may be extended to those accessory variants which, as such, come within its scope.

Claims

1. A laundry washer drier comprising a rotatable drum (3) for holding the laundry and disposed in a surrounding enclosure, a substantially closed air circulation path including a duct (4) leading from the enclosure to a device (7) for causing circulation of air, and means (6) for supplying cooling water for cooling moist air flowing in the air circulation path, characterised in that the means (6) for supplying cooling water is arranged to deliver the water into the interspace (5) between the drum and the surrounding enclosure.

2. A laundry washer-drier as claimed in claim 1, characterised in that the introduction of cooling water into the drum enclosure interspace (5) is at a side where the drum has no perforations.

3. A laundry washer-drier as claimed in claim 1 or 2, characterised in that the cooling water is introduced via a detergent dispenser (9) of the washer-drier.

4. A laundry washer-drier as claimed in any one of the preceding claims, characterised in that moisture detection sensing means are provided to monitor the drying cycle.

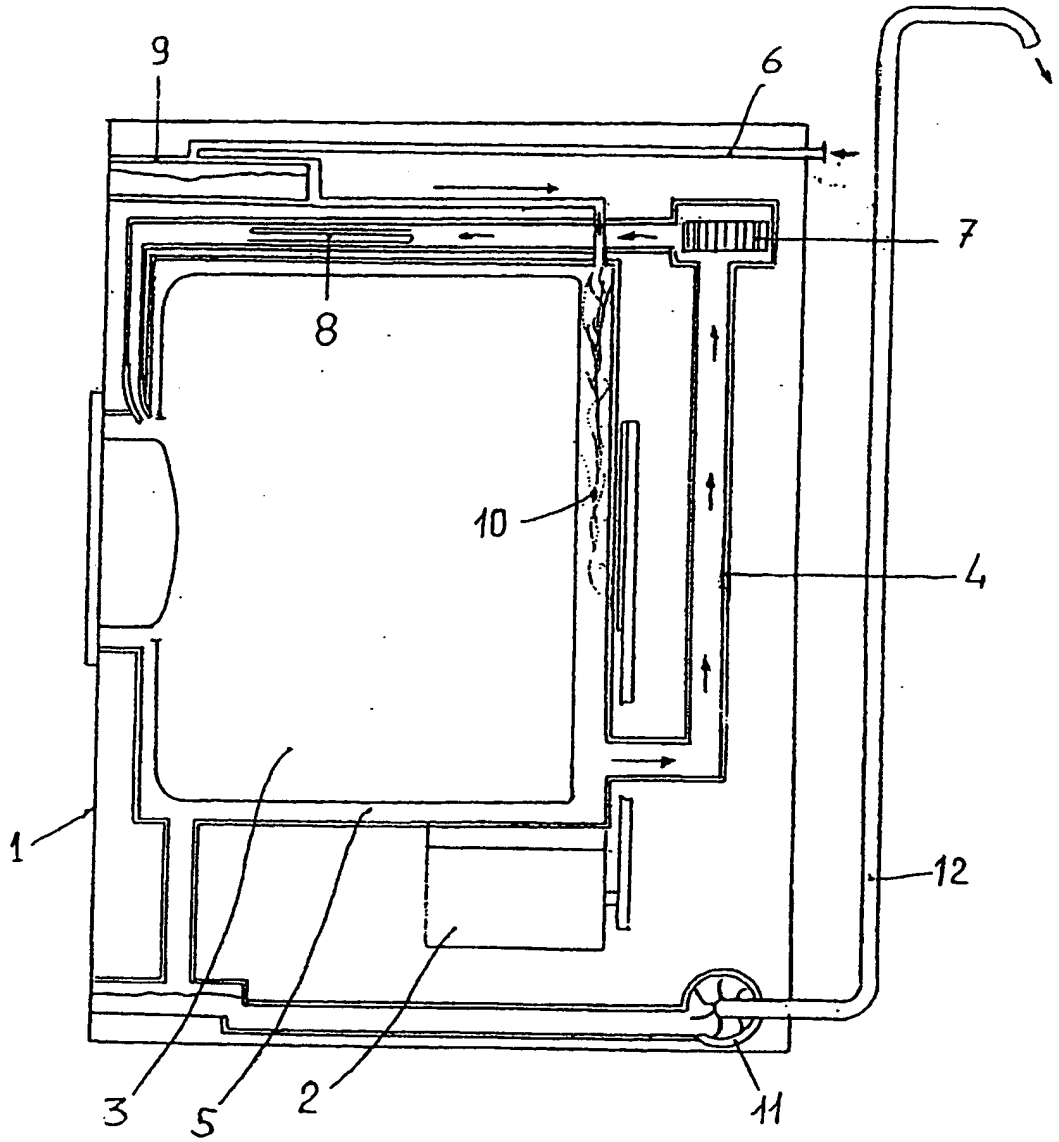

FIG.1

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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0457

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION
X	DE-A-15 85 675 (CONSTRUCTA-WERKE GMBH) * page 3; figure *	1,2	D06F58/24
X	DE-A-25 45 795 (AUGUST LEPPER MASCHINEN-U.APPARATEBAU GMBH) * page 9, line 5 - line 16; figures 3,4 * * page 9, line 25 - page 10 *	1	
A	DE-A-21 07 313 (SIEMENS-ELECTROGERÄTE GMBH) * claims 1,4; figures *	1,3	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 January 1995	Courrier, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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